

Evidence of Evolution

Indirect Evidence
and
Direct Evidence

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Indirect Evidence

Evidence we can look at today that suggests we may have a common ancestry with other organisms.

Three types of Indirect Evidence:

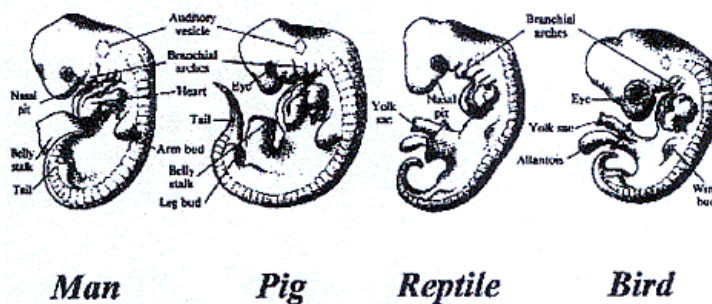
- 1) Embryological Similarities
- 2) Comparative Morphology
- 3) Similarities in Biochemistry

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Embryological Similarities

Different species of the same class often have very similar embryos, even if the adult forms are quite different. For example fish embryos and human embryos both have gill slits (but in humans they disappear before birth). This shows that the animals are similar and that they develop similarly, implying that they have a common ancestor and that they started out the same, gradually evolving different traits.

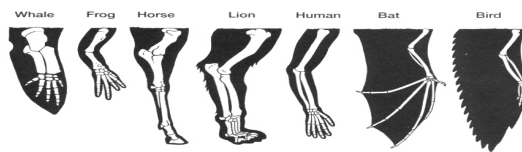
Figure 2: Homologous Similarity Among Vertebrate Embryos



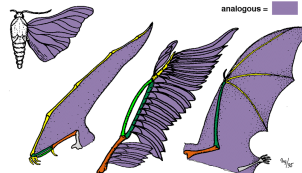
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Comparative Morphology

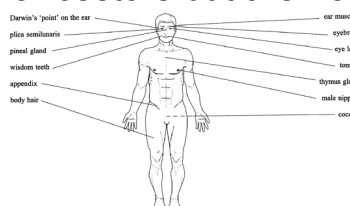
Homologous Structures - have similar structures but different functions.



Analogous Structures - different structures with similar functions



Vestigial Structures - anatomical remnants that were important in the organism's ancestors but are no longer used in the same way.



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Similarities in Biochemistry (Molecular Biology)

DNA similarities (98% of our DNA is the same as a chimpanzee)

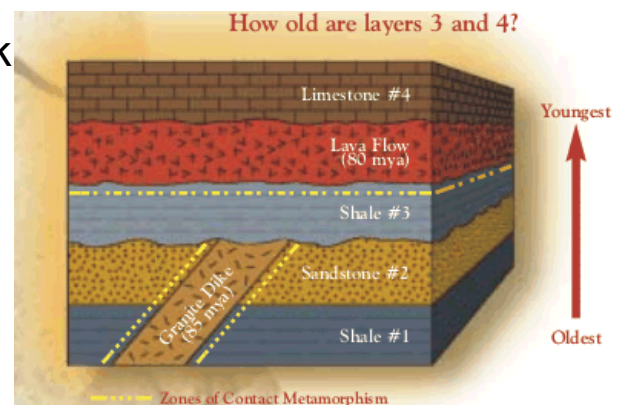
Protein in all organisms is composed of the same 20 amino acids!!

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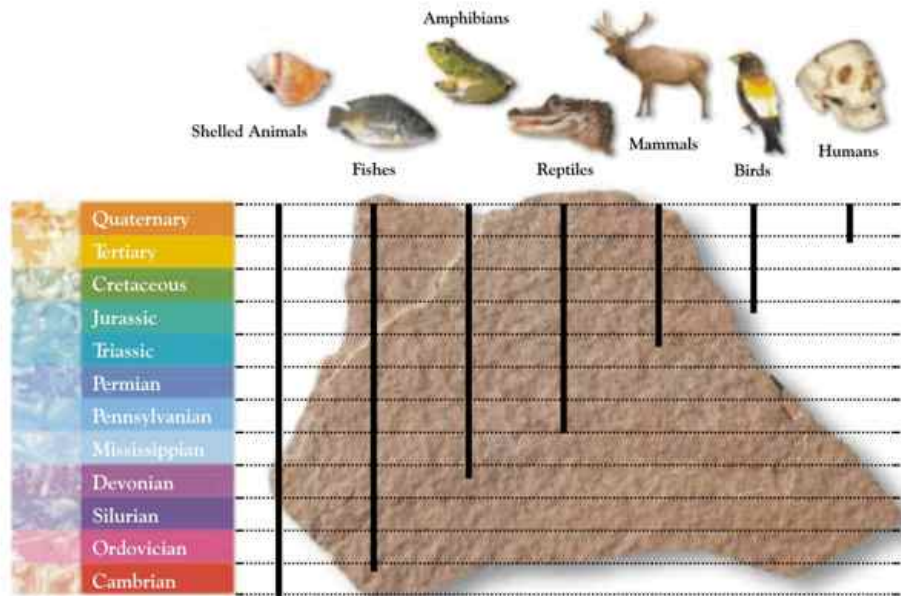
Direct Evidence of Evolution

Fossil Record - is one of the most important databases that documents changes in past life on Earth. The fossil record clearly shows changes in life through almost any sequence of sedimentary rock layers. Successive rock layers contain different groups of fossil species.

Each layer of sedimentary rock acts as a boundary between the Eras and are defined by major changes in the types of fossils found in the rocks.



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Dating the Fossil Record

Aging a rock or fossil involves using minerals that contain radioactive elements and measuring the amount of change or decay in those elements. These particles emit particles and energy at a relatively constant rate, transforming themselves through the decay process. This rate of decay is measurable and is not affected by external factors.

The decay from parent to daughter happens at a constant rate called the half-life. (The length of time it takes for exactly one-half of the parent atoms to decay to daughter atoms)

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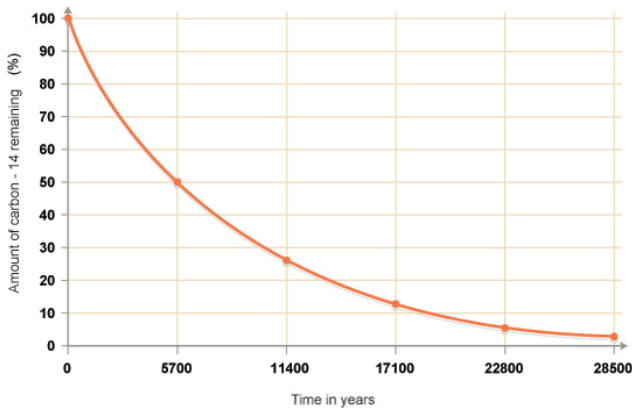
Isotopic Age Dating

Method	Parent/Daughter Isotopes	Half-Lives	Materials Dated	Age Dating Range
Carbon (C)/Nitrogen (N)	C-14/N-14	5,730 yrs.	Shells, limestone, organic materials	100-50,000 yrs.
Potassium (K)/Argon (Ar)	K-40/Ar-40	1.3 billion yrs.	Biotite, whole volcanic rock	100,000-4.5 billion yrs.
Rubidium (Rb)/Strontium (Sr)	Rb-87/Sr-87	47 billion yrs.	Micas	10 million-4.5 billion+ yrs.
Uranium (U)/Lead (Pb)	U-238/Pb-206	4.5 billion yrs.	Zircon	10 million-4.5 billion+ yrs.
Uranium (U)/Lead (Pb)	U-235/Pb-207	710 million yrs.	Zircon	10 million-4.5 billion+ yrs.

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Radioactive Carbon Dating

- A dating technique commonly used with organic life forms.
- Found to be fairly accurate especially when compared with other dating methods.
- The half life of C 14 is 5730 years



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